

Why are fossils rare?

TEACHER DEMONSTRATION

Compression and compaction (Option).

In the process of burial, the weight of overlying sediment causes the materials to become compacted and cemented. An inverted bell jar or large food jar can be filled with alternating layers of sand, moist fresh leaves and ripe tomatoes or small inflated balloons (make sure they are against the glass). The jar should then be sealed and placed upright. Over time the leaf and tomato layers collapse. Balloons can take two weeks to compress. Plastic animals, being hard, do not compress.

TEACHERS NOTES

Fossils also have to survive compaction and cementation processes which turn sediments into rock. Rock must be uplifted and eroded to expose the fossil. Even drilling into strata known to contain fossils does not mean you will necessarily intersect any. Students create sedimentary sandwiches containing replica fossils, compact them and then drill into them to try and intersect a fossil.

Materials provided in the kit

- Student worksheet “Sedimentary sandwiches”

Materials provided by teacher

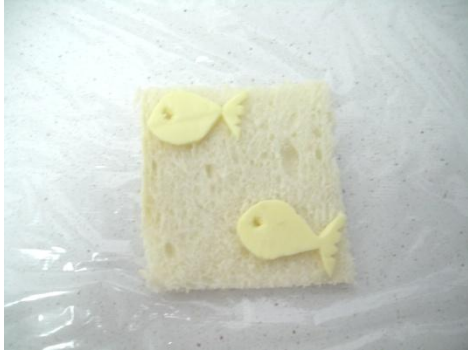
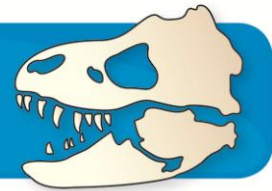
- Board and knife to cut shapes and remove bread crusts
- Sliced bread – different types make interesting rock strata. Remove crusts first
- Processed cheese slices
- Optional margarine or butter
- Jelly lollies (thinly sliced snakes are good)
- Cling wrap
- Drinking straws



1. Students wash their hands and lay down cling wrap.
2. Students place the first slice of bread on cling wrap to represent the first layer of sediment deposited on the sea bottom.
3. Students cut cheese into small fossil like shapes and randomly place three of these on the first slice of bread. These are the bodies of dead animals which fell to the bottom of the sea and despite scavengers and microorganisms, survived. Fossils are not evenly distributed in rocks, so there will be zones with fossils and zones without.



fossils

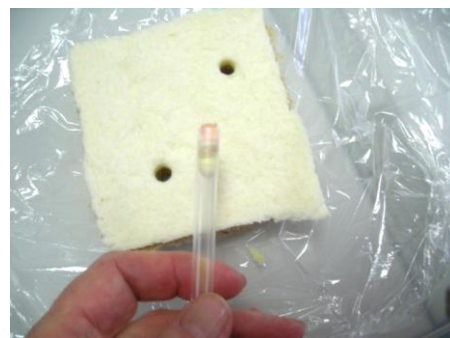
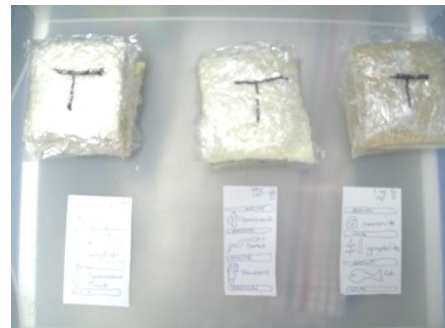


Fossil fish

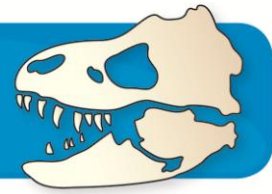


Descriptions of the rock columns

4. Students create a visual representation of which fossils were placed in each layer. (Above right)
5. This layer is covered with another slice of bread and more fossils (or not). Repeat until a stack of sediments with some fossils is created. At least one fossil free layer should be included.
6. When stack is complete, students wrap with the cling wrap and mark the top of the sandwich/sedimentary rock column.
7. The height of the stack or sedimentary column is measured.
8. Place these columns on a flat surface and cover and compress with a heavy weight (books?) to represent compaction (crushing) under the weight of overlying sediment within the Earth. If you wish, students can sit on their stack for 10 minutes to compact it. If you intend eating the sandwiches they can be "drilled" immediately. The impressions or "moulds" of fossils and the seepage of oils from the cheese can be observed. This seepage from animal fossils is the source of oil which migrates to traps and collects there to form oil fields such as those offshore from Barrow Island.
9. Re-measure height. (See note below).
10. Students can estimate the degree of compaction. $\text{Compacted height} \div \text{original height} \times 100$
11. Use the plastic straw to drill down into the sediment and see if you intersect (cut through) a fossil. When you withdraw the straw you will see a sedimentary sequence similar to the rock sequence seen in diamond drill core. Students should be encouraged to squeeze out the drill section rather than blowing it out!



fossils



12. Open compacted sandwich, observe the effects of compaction and count the numbers of fossils intersected.
13. Students may discuss how many holes have to be drilled before we can discover the sedimentary and fossil history of the rock column. The cost of drilling is great. The hire of a rig to drill an oil well is over one million dollars a day. Traditional strategies involved drawing a square grid centered on the first find and moving outwards to find any patterns which could indicate future drilling directions. Recently a spiral pattern centered on the original find has been employed.

Since the formation of fossils requires materials to be buried deeply, it is only when uplift due to folding or faulting brings rocks to the surface that fossils are commonly found. This explains how fossil beaches can be found at the top of Mt Everest.

If you intend eating the sandwiches they can be “drilled” after 2.5 hours of book pressing or 5 minutes of under-bottom compaction. Students should be able to observe the impressions or “moulds” of fossils and the seepage of oils from the cheese. Seepage from animal fossils is the source of oil which migrates to traps and collects there to form oil fields such as those offshore from Barrow Island.

How had your fossils changed because of the forces of compaction applied to them?

Deformed, thinner, broken

Drill core



Extension

As materials are buried deeper and deeper within the Earth they become increasingly hot and compacted. This is called regional metamorphism. When however rocks are locally “cooked” by an igneous intrusion of a volcano, dyke or sill with minimum pressure, this is known as contact metamorphism.

Students can use a heated sandwich press to mimic regional metamorphism and a simple grill to mimic contact metamorphism .

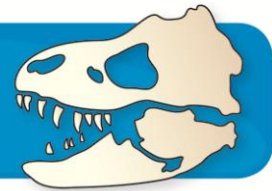
Regional

One sandwich is left un-pressed and un-heated as the **control**. A second identical sandwich is heated and pressed and the results compared with the control.

Contact

One sandwich is grilled and the other left untouched as the Control.

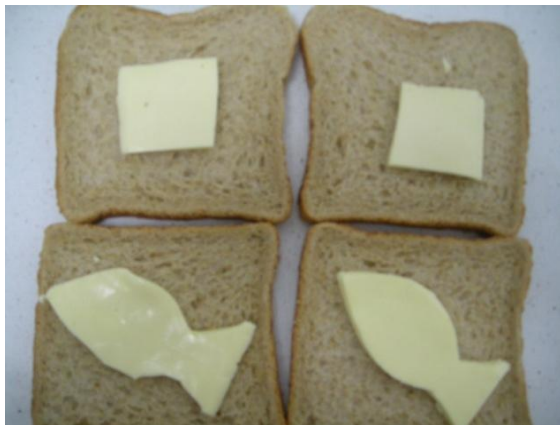
fossils



All data should be:

Observable, Measurable, Repeatable and Reportable

Measuring deformation caused by heat and pressure is difficult. If the initial material has a regular geometric shape such as a square or cube, a simple ruler is sufficient. If however the original shape is irregular, measurement is more difficult. If graph paper is printed on transparent film (e.g. an overhead sheet) the percentage change can be measured by overlaying the material with a transparent grid and counting squares.

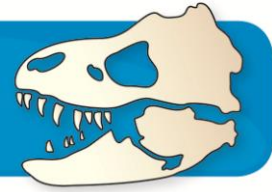


Control and experimental models (before)



Comparison Of heated (left) & Control (right)

Students may be encouraged to **compare** (similarities) and **contrast** (differences) for the experimental sandwich and the control.



Revision and wordsleuth

What is a fossil?

Fossils represent the remains or traces of ancient life that lived in the geologic past

1. What are the three things which attack and destroy plants and animal bodies at the surface of the Earth? Name an example of each.

Predators *example dingo/dog/cat*

Scavengers *example magpies/rats*

Decomposers *example bacteria & fungi*

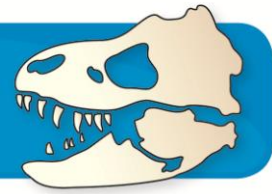
2. Under which conditions would a dead body last longer? Circle the correct answer.
 - a. Warm and wet
 - b. Warm and dry
 - c. Cold and wet
 - d. Cold and dry**
3. Once the bodies have been buried in sediment, what else can attack them?

Groundwater and the force of compaction



Fossil crinoid or sea lily from near Geraldton W. Photograph courtesy of Enza

fossils



Fossilisation Word Sleuth

E L B A T A E P E R L D P S M
R K G R O U N D W A T E R C E
O C A S T X H S I D T C A A A
S O D E E M Y R U R C O L V S
I M E D M M U G I H O M K E U
O P P I P B E F E G M P A N R
N R O M E U I Y T N P O L G A
F E S A R C Q N M I A S I E B
M S I N A G R O O R C I M R L
F S T T T K D L I E T T L S E
B I I A U C I O S H I I I T I
K O O R R O C C T T O O S R G
N N N Y E R A R U A N N S A N
R N C E L B A V R E S B O T U
S T E R I L I S E W K E F A F

ACID

ALKALI

BONE

BURIAL

CAST

COLONY

COMPACTION

COMPRESSION

DECOMPOSITION

DEPOSITION

DISH

EROSION

FOSSIL

FUNGI

GROUNDWATER

MEASURABLE

MICROORGANISM

MOISTURE

OBSERVABLE

OXYGEN

PETRI

PETRIFICATION

RARE

REPEATABLE

ROCK

SCAVENGERS

SEDIMENTARY

STERILISE

STRATA

TEMPERATURE

WEATHERING